<table>
<thead>
<tr>
<th>Question number</th>
<th>Answer</th>
<th>Marks</th>
<th>Guidance</th>
</tr>
</thead>
</table>
| 1              | In each section:  
• If wrong or no reagent given, no marks for any observations;  
• Penalise incomplete reagent or incorrect formula – but mark observations  
• Mark each observation independently  
• Allow no reaction for no change / no observable reaction in all three parts, but not none or nothing  
• Q says one test. If two tests are given, score zero | | |

### 1 (a)

<table>
<thead>
<tr>
<th>R primary alcohol</th>
<th>K$_2$Cr$_2$O$_7$ / H$^+$</th>
<th>KMnO$_4$ / H$^+$</th>
<th>Lucas test (ZnCl$_2$ / HCl)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Orange) goes green</td>
<td>(purple) goes colourless</td>
<td>No cloudiness</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>S tertiary alcohol</th>
<th>no change</th>
<th>no change</th>
<th>Rapid cloudiness</th>
</tr>
</thead>
</table>

1 mark for reagent, 1 mark for R observation, 1 mark for S observation.

- Allow acidified potassium manganate and acidified potassium dichromate without oxidation numbers
- Penalise wrong starting colour

### 1 (b)

<table>
<thead>
<tr>
<th>T ester</th>
<th>Na$_2$CO$_3$ / NaHCO$_3$ named carbonate</th>
<th>metal</th>
<th>named indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>No change</td>
<td>No change</td>
<td>No effect</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>U acid</th>
<th>Effervescence or (CO$_2$) gas formed</th>
<th>Effervescence or (H$_2$) gas formed</th>
<th>acid colour</th>
</tr>
</thead>
</table>

1 mark for reagent, 1 mark for R observation, 1 mark for S observation.

- Also accept PCl$_5$, PCl$_3$, SOCl$_2$, Named alcohol + HCl / H$_2$SO$_4$
- No change, no change
- Fumes / (HCl) gas formed, Sweet smell
<table>
<thead>
<tr>
<th></th>
<th>Fehling’s / Benedict’s</th>
<th>Tollens’ / [Ag(NH₃)₂]⁺</th>
<th>K₂Cr₂O₇ / H⁺</th>
</tr>
</thead>
<tbody>
<tr>
<td>V</td>
<td>Ketone</td>
<td>no change</td>
<td>no change</td>
</tr>
<tr>
<td>W</td>
<td>Aldehyde</td>
<td>Red precipitate</td>
<td>Silver mirror</td>
</tr>
</tbody>
</table>

1 mark for reagent, 1 mark for R observation, 1 mark for S observation.

penalise wrong starting colour
If 2 stage test for one compound, award no marks for that compound, e.g., no mark for ROH or RX to alkene then Br₂ test.

If reagent is wrong or missing, no mark for that test; if wrong but close/incomplete, lose reagent mark but can award for correct observation. In each test, penalise each example of wrong chemistry, e.g., AgCl₂.

<table>
<thead>
<tr>
<th>Alcohol</th>
<th>Reagents/Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>Propan-1-ol</td>
<td>Acidified potassium dichromate sodium named acid + conc H₂SO₄ named acyl chloride PCl₅</td>
</tr>
<tr>
<td></td>
<td>(orange) turns Green effervescence Sweet smell Sweet smell /misty fumes Misty fumes</td>
</tr>
<tr>
<td>Propanal</td>
<td>add Tollens OR Fehling’s / Benedict’s acidified potassium dichromate Brady’s or 2,4-dnph (orange) turns Green Yellow or orange precipitate</td>
</tr>
<tr>
<td>Propanoic acid</td>
<td>Named carbonate/ hydrogencarbonate water and UI (paper) Named alcohol + conc H₂SO₄ Sodium or magnesium PCl₅</td>
</tr>
<tr>
<td></td>
<td>effervescence orange/red Sweet smell effervescence Misty fumes</td>
</tr>
<tr>
<td>1-Chloro propane</td>
<td>NaOH then acidified AgNO₃ AgNO₃ white ppt white ppt</td>
</tr>
</tbody>
</table>

1 if dichromate used for alcohol cannot be used for aldehyde
1 if sodium used for alcohol cannot be used for acid
1 if PCl₅ used for alcohol cannot be used for acid
1 If acidification missed after NaOH, no mark here but allow mark for observation
### Question 3

**L:**

![Structure image]

**M:**

![Structure image]

**Step 1:** NaBH₄ OR LiAlH₄ OR Zn/HCl OR H₂/Ni OR H₂/Pt

- **nucleophilic addition**

**Step 2:** conc H₂SO₄ OR conc H₃PO₄ OR Al₂O₃

- **Elimination**

**Step 3:** HBr

- **electrophilic addition**

1. Allow (CH₃)₂CHOH OR CH₃CH(OH)CH₃. Allow name propan-2-ol. Penalise contradiction of name and structure

1. Allow CH₃CH=CH₂. Allow name propene ignore -1- but penalise other numbers. Penalise contradiction of name and structure

1. Ignore name if formula is correct ignore solvent ignore acid (for 2nd step) but penalise acidified NaBH₄ Apply list principle for extra reagents and catalysts


1. Apply list principle for extra reagents and catalysts.

1. Independent from M5 penalise nucleophilic or electrophilic ignore dehydration Apply list principle for extra reagents and catalysts. Independent from M7

### Question 4

1. **(a) (i)** C₆H₅NO₂  

2. **(a) (ii)** CH₃(CH₂)₂CH₃  

3. **(a) (iii)** CH₃COOH  

4. **(b) (i)** catalyst  

5. **(b) (ii)** catalyst  

6. **(b) (iii)** oxidising agent  

### Question 5

1. Add sodium hydroxide and warm  
2. Add nitric acid  
3. Add silver nitrate solution  
4. If compound A is a chloroalkane a white precipitate of silver chloride would be formed.

### Question 6

1. **(a)** aldehyde  

2. **(b)** propanone  

### Question 7

1. Add bromine water to the sample and shake.  
2. If a C=C is present the bromine water would decolourise.